PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

To:
GEOFFREY L. MELNICK
G. E. EHRLICH (1995) LTD.
11 MENACHEM BEGIN STREET
RAMAT-GAN, ISRAEL 52 521

PCT

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43*bis*.1)

Date of mailing (*day/month/year*)	09 JAN 2007
Applicant's or agent's file reference 29081	**FOR FURTHER ACTION** See paragraph 2 below

International application No.	International filing date (*day/month/year*)	Priority date (*day/month/year*)
PCT/IL05/00166	10 February 2005 (10.02.2005)	30 May 2004 (30.05.2004)

International Patent Classification (IPC) or both national classification and IPC

IPC(7): B41J 23/00, 2/01; G03B 27/32,42 and US Cl.: 347/37,104,102; 355/53

Applicant

KORNIT DIGITAL LTD.

1. This opinion contains indications relating to the following items:

- ☒ Box No. I — Basis of the opinion
- ☐ Box No. II — Priority
- ☐ Box No. III — Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV — Lack of unity of invention
- ☒ Box No. V — Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☒ Box No. VI — Certain documents cited
- ☐ Box No. VII — Certain defects in the international application
- ☐ Box No. VIII — Certain observations on the international application

2. **FURTHER ACTION**

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1*bis*(*b*) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

3. For further details, see notes to Form PCT/ISA/220.

Name and mailing address of the ISA/ US	Date of completion of this opinion	Authorized officer
Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1450 Alexandria, Virginia 22313-1450 Facsimile No. (571) 273-3201	10 October 2006 (10.10.2006)	STEPHEN D MEIER Telephone No. (571)272-1562

Form PCT/ISA/237 (cover sheet) (April 2005)

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/IL05/00166

Box No. I Basis of this opinion

1. With regard to the **language**, this opinion has been established on the basis of:

☒ the international application in the language in which it was filed

☐ a translation of the international application into _____, which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b)).

2. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application and necessary to the claimed invention, this opinion has been established on the basis of:

a. type of material

☐ a sequence listing

☐ table(s) related to the sequence listing

b. format of material

☐ on paper

☐ in electronic form

c. time of filing/furnishing

☐ contained in the international application as filed.

☐ filed together with the international application in electronic form.

☐ furnished subsequently to this Authority for the purposes of search.

3. ☐ In addition, in the case that more than one version or copy of a sequence listing and/or table(s) relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

4. Additional comments:

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/IL05/00166

Box No. V Reasoned statement under Rule 43 *bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims NONE	YES
	Claims 1-81	NO
Inventive step (IS)	Claims NONE	YES
	Claims 1-81	NO
Industrial applicability (IA)	Claims 1-81	YES
	Claims NONE	NO

2. Citations and explanations:

Please See Continuation Sheet

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/IL05/00166

Box No. VI Certain documents cited

1. Certain published documents (Rules 43*bis*.1 and 70.10)

Application No. Patent No.	Publication date (day/month/year)	Filing date (day/month/year)	Priority date (valid claim) (day/month/year)
US 2003/0142167 A1	31/07/2003	22/11/2002	28/11/2001
US 5757407	26/05/1996	25/11/1996	
US 6536894	25/03/2003	06/06/2000	
US 6755518	29/06/2004	21/11/2001	30/08/2001
US 2003/0197772	23/10/2003	22/04/2003	23/04/2002

2. Non-written disclosures (Rules 43*bis*.1 and 70.9)

Kind of non-written disclosure	Date of non-written disclosure (day/month/year)	Date of written disclosure referring to non-written disclosure (day/month/year)

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In case the space in any of the preceding boxes is not sufficient.

V. 2. Citations and Explanations:

1. Claims 13-19, 32-81 lack an inventive step under PCT Article 33(3) as being obvious over Iwatsuki et al. (US 2003/0197772 A1) in view of Codos (US 6755518) and Rasmussen et al. (US 6536894).

Iwatsuki et al. discloses a printing machine comprising:

a rigid frame (*FIG. 1, element 1*);

a linear motion X axis stage (*FIG. 1, elements 11, 11a-b*) mounted on said frame;

a printing table assembly (*FIG. 1, elements 12, 13, 15*) movable on said linear X axis stage (*FIG. 1: The stage 11 linearly moves from FRONT SIDE to REAR SIDE and versa*);

a linear motion Y axis stage (*FIG. 1, elements 2-4*) mounted on said frame perpendicular to said linear X axis stage, above said printing table assembly (*FIG. 1: The carriage 4 moves along a direction perpendicular to the moving direction of printing table assembly 11*);

an array of inkjet nozzles (*FIG. 1, element 5 and paragraph [0066]: The printing head 5 has a plurality of nozzles*) mounted on said linear Y axis stage for linear motion perpendicular to said X axis stage (*FIG. 1: The carriage 4 moves the printhead 4 across the printing table assembly*).

Iwatsuki et al., however, does not teach a curing unit located above said printing table assembly and arranged to cure ink on media on said printing assembly, wherein said curing unit is an infrared system or a hot air blowing unit and wherein at least part of said printing table assembly is a vacuum table.

Codos discloses an ink jet printing apparatus mounted on a rigid frame (*FIG. 1, element 11*) and including an ink jet printhead assembly (*FIG. 1, element 125*) for forming images on a printing medium (*FIG. 1, element 15*) conveyed by a vacuum conveyor (*FIG, 1, element 105, 121*) and a curing unit located above the printing medium to cure ink deposited on the printing medium, wherein said curing unit is an infrared system or a hot air blowing unit (*FIG. 1, elements 124, 126; column 8, lines 62-64: Heating by forced hot air is preferred, although other heat sources, such as infrared heaters can be used*).

Therefore, it would have been obvious for one having ordinary skill in the art at the time invention was made to modify Iwatsuki et al.'s printing apparatus to include a curing unit to cure ink deposited on the printing medium as disclosed by Codos. The motivation for doing so would have been to cure the ink upon its contacting the substrate (printing medium) to prevent ink spreading and wicking that affect printing quality as taught by Codos (*column 2, lines 65-67*).

In addition, Iwatsuki et al. does not teach an ironing unit located above said printing table assembly and arranged to iron media on said printing assembly before printing thereon.

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Rasmussen et al. discloses an ink jet printing apparatus including an ink jet printhead (*FIG. 2B, element 14*) for forming images on a printing medium conveyed by a conveyor (*32*) and an ironing unit located above said printing medium and arranged to iron said printing media before printing thereon (*FIG. 2B, elements 201', 202; column 3, lines 32-38: Heating and pressing the print media upstream of printing to flatten print media prior to ink jet printing thereon*).

Therefore, it would have been obvious for one having ordinary skill in the art at the time invention was made to modify Iwatsuki et al.'s printing apparatus to include an ironing unit located above the printing medium to iron the printing media before printing as disclosed by Rasmussen et al. The motivation for doing so would have been to provide a flat and stable media for printing in order to improve image quality as taught by Rasmussen et al. (*column 4, lines 19-24*).

Iwatsuki et al. also teaches the following claimed invention:

wherein said printing table assembly comprises a media-holding plate (*FIG. 5A-D, element 15*) and an openable cover (*FIG. 1, element 14*) pivotally coupled to said media-holding plate for holding said media firmly against said plate (*FIG. 5A-D*).

wherein said media-holding plate (*FIG. 5A-D, element 15*) includes a raised portion (*FIG. 5A-D, element 12*), and said cover includes a window (*FIG. 5A-D: The window is defined by the inner frame 19 of the frame structure (cover) 14*) of the same shape and slightly larger than said raised portion (*FIG. 5A-D, elements 12 and 19: The width of the inner frame (window) 19 is slightly wider than that of the raise portion 12*).

wherein said printing table assembly is a flattened plate (*FIG. 5A-D, elements 12-13 and 15*).

2. Claims 20-21 lack an inventive step under PCT Article 33(3) as being obvious over Iwatsuki et al. (US 2003/0197772 A1) in view of Codos (US 6755518) and Rasmussen et al. (US 6536894), as applied to claim 13, and further in view of Rezanka (US 5757407).

Iwatsuki et al., as modified, discloses the claimed invention as discussed above and also teaches wherein the printhead includes inkjet nozzles, but is silent wherein said inkjet nozzles include drop-on-demand piezoelectric inkjet nozzles or continuous piezoelectric inkjet nozzles.

Rezanka discloses an ink jet printing apparatus comprising ink jet nozzles including either drop-on-demand piezoelectric inkjet nozzles or continuous piezoelectric inkjet nozzles (*column 12, lines 10-13*) for ejecting ink droplets to form images on a printing medium.

Therefore, it would have been obvious for one having ordinary skill in the art at the time invention was made to structure the inkjet printhead in Iwatsuki et al.'s printing apparatus (as modified) to include either drop-on-demand piezoelectric inkjet nozzles or continuous piezoelectric inkjet nozzles for ejecting ink droplets to form images on a printing medium as disclosed by Rezanka. The motivation for doing so would have been well known in the art that because drop-on-demand or continuous piezoelectric ink jet nozzles do not produce heat during ink ejection like thermal inkjet nozzles so the ink ejection is more stable due to less variation in term of the temperature than that in case of thermal inkjet nozzles.

3. Claims 1-3, 22, 27-28 lack an inventive step under PCT Article 33(3) as being obvious over Iwatsuki et al. (US 2003/0197772 A1) in view of Morita et al. (US 6879378).

Iwatsuki et al. discloses a printing machine comprising:

a rigid frame (*FIG. 1, element 1*);

a first linear motion X axis stage (*FIG. 1, elements 11, 11a-b*) mounted on said frame;

a first printing table assembly (*FIG. 1, elements 12, 13, 15*) movable on said linear X axis stage (*FIG. 1: The stage 11 linearly moves from FRONT SIDE to REAR SIDE and versa*);

a linear motion Y axis stage (*FIG. 1, elements 2-4*) mounted on said frame perpendicular to said linear X axis stage, above said printing table assembly (*FIG. 1: The carriage 4 moves along a direction perpendicular to the moving direction of printing table assembly 11*);

an array of inkjet nozzles (*FIG. 1, element 5 and paragraph [0066]: The printing head 5 has a plurality of nozzles*) mounted on said linear Y axis stage for linear motion perpendicular to said X axis stage (*FIG. 1: The carriage 4 moves the printhead 4 across the printing table assembly*).

Iwatsuki et al., however, does not teach a second linear motion X axis stage mounted on said frame parallel to said first axis stage, and arranged for operation independently of said first axis stage or a second printing table assembly movable on said linear X axis stage base independently of said first printing table assembly.

Morita et al. discloses an image forming apparatus for forming a pattern on each of at least two workpieces positioned on associated linearly movable support tables/stages, wherein the linearly movable support tables/stages (*FIG. 6, elements 10, 20*) are mounted on the same frame (*FIG. 6, element 5*), being parallel, and arranged for independently operation (*FIG. 6: The two tables 10, 20 move along the parallel directions L1 and L2 and each having independent*

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function at a time).

Therefore, it would have been obvious for one having ordinary skill in the art at the time invention was made to modify Iwatsuki et al.'s printing apparatus to include a second table/stage that is parallel and independently operates from the first table/stage as disclosed by Morita et al. The motivation for doing so would have been to be able to alternatively transfer the tables between a load/unload position and an image/pattern forming position and alternatively form images/patterns on the tables so at least two workpieces can be processed simultaneously in order to increase the throughput of the apparatus as taught by Morita et al. (*column 3, lines 45-59*).

Iwatsuki et al. also teaches the following claimed invention:

wherein said printing table assembly comprises a media-holding plate (*FIG. 5A-D, element 15*) and an openable cover (*FIG. 1, element 14*) pivotally coupled to said media-holding plate for holding said media firmly against said plate (*FIG. 5A-D*).

wherein said media-holding plate (*FIG. 5A-D, element 15*) includes a raised portion (*FIG. 5A-D, element 12*), and said cover includes a window (*FIG. 5A-D: The window is defined by the inner frame 19 of the frame structure (cover) 14*) of the same shape and slightly larger than said raised portion (*FIG. 5A-D, elements 12 and 19: The width of the inner frame (window) 19 is slightly wider than that of the raise portion 12*).

4. Claims 7-8, 30-31 lack an inventive step under PCT Article 33(3) as being obvious over Iwatsuki et al. (US 2003/0197772 A1) in view of Morita et al. (US 6879378), as applied to claims 1 and 22, and further in view of Rezanka (US 5757407).

Iwatsuki et al., as modified, discloses the claimed invention as discussed above and also teaches wherein the printhead includes inkjet nozzles, but is silent wherein said inkjet nozzles include drop-on-demand piezoelectric inkjet nozzles or continuous piezoelectric inkjet nozzles.

Rezanka discloses an ink jet printing apparatus comprising ink jet nozzles including either drop-on-demand piezoelectric inkjet nozzles or continuous piezoelectric inkjet nozzles (*column 12, lines 10-13*) for ejecting ink droplets to form images on a printing medium.

Therefore, it would have been obvious for one having ordinary skill in the art at the time invention was made to structure the inkjet printhead in Iwatsuki et al.'s printing apparatus (as modified) to include either drop-on-demand piezoelectric inkjet nozzles or continuous piezoelectric inkjet nozzles for ejecting ink droplets to form images on a printing medium as disclosed by Rezanka. The motivation for doing so would have been well known in the art that because drop-on-demand or continuous piezoelectric ink jet nozzles do not produce heat during ink ejection like thermal inkjet nozzles so the ink ejection is more stable due to less variation in term of the temperature than that in case of thermal inkjet nozzles.

5. Claims 6, 9-11, 24-26, and 29 lack an inventive step under PCT Article 33(3) as being obvious over Iwatsuki et al. (US 2003/0197772 A1) in view of Morita et al. (US 6879378), as applied to claims 1 and 22, and further in view of Codos (US 6755518).

Iwatsuki et al., as modified, discloses the claimed invention as discussed above except a curing unit located above each said printing table assembly and arranged to cure ink on media on said printing assembly, wherein said curing unit is an infrared system or a hot air blowing unit, and wherein at least part of said printing table assembly is a vacuum table.

Codos discloses an ink jet printing apparatus including an ink jet printhead (*FIG. 1, element 125*) for forming images on a printing medium (*FIG. 1, elements 15*) conveyed by a vacuum conveyor (*FIG, 1, element 105, 121*) and a curing unit located above the printing medium to cure ink deposited on the printing medium, wherein said curing unit is an infrared system or a hot air blowing unit (*FIG. 1, elements 124, 126; column 8, lines 62-64: Heating by forced hot air is preferred, although other heat sources, such as infrared heaters can be used*).

Therefore, it would have been obvious for one having ordinary skill in the art at the time invention was made to modify Iwatsuki et al.'s printing apparatus (as modified) to include a curing unit to cure ink deposited on the printing medium as disclosed by Codos. The motivation for doing so would have been to cure the ink upon its contacting the substrate (printing medium) to prevent ink spreading and wicking that affect printing quality as taught by Codos (*column 2, lines 65-67*).

6. Claims 12 and 23 lack an inventive step under PCT Article 33(3) as being obvious over Iwatsuki et al. (US 2003/0197772 A1) in view of Morita et al. (US 6879378), as applied to claims 1 and 22, and further in view of Rasmussen et al. (US 6536894).

Iwatsuki et al., as modified, discloses the claimed invention as discussed above except an ironing unit located above each said printing table assembly and arranged to iron media on said printing table assemblies.

Rasmussen et al. discloses an ink jet printing apparatus including an ink jet printhead (*FIG. 2B, element 14*) for

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forming images on a printing medium conveyed by a conveyor (*32*) and an ironing unit located above said printing medium and arranged to iron said printing media before printing thereon (*FIG. 2B, elements 201', 202; column 3, lines 32-38: Heating and pressing the print media upstream of printing to flatten print media prior to ink jet printing thereon*).

Therefore, it would have been obvious for one having ordinary skill in the art at the time invention was made to modify Iwatsuki et al.'s printing apparatus (as modified) to include an ironing unit located above the printing medium to iron the printing media before printing as disclosed by Rasmussen et al. The motivation for doing so would have been to provide a flat and stable media for printing in order to improve image quality as taught by Rasmussen et al. (*column 4, lines 19-24*).

7. Claims 4-5 lack an inventive step under PCT Article 33(3) as being obvious over Iwatsuki et al. (US 2003/0197772 A1) in view of Morita et al. (US 6879378), as applied to claim 1, and further in view of Nakamura et al. (US 2003/0142167 A1).

Iwatsuki et al., as modified, discloses the claimed invention as discussed above except wherein said linear motion X axis stage is a linear motor driven stage and said linear motion Y axis stage is a linear motor driven stage.

Nakamura et al. discloses an ink jet printing apparatus comprising a linear motion X axis stage (*FIG. 9, elements 19, 52-53*) to convey an ink jet printhead (*FIG. 9, element 22*) to form images on a printing medium (*FIG. 9, element 12*) positioned on a printinb table (*FIG. 9, element 49*) conveyed by a linear motion Y axis stage (*FIG. 9, elements 21, 54, 56*), wherein both X and Y linear motion stages are linear motor driven stages (*paragraphs [0103]-[0104]: An X slider/stage 53 contains a linear motor. A Y slider/stage 56 contains a linear motor. The X and Y sliders move when the associated built-in linear motor is opera*ted).

Therefore, it would have been obvious for one having ordinary skill in the art at the time invention was made to modify Iwatsuki et al.'s printing apparatus (as modified) to move/drive the stages by linear motors as disclosed by Nakamura et al. The motivation for doing so would have been because it is possible to control a position of the ink jet head supported by the X stage and a position of the printing table supported by the Y stage very precisely as taught by Nakamura (*paragraph [0105]*).

8. Claims 1-81 meet the criteria set out iin PCT Article 33(4) and thus the claims meet industrial applicability because the subject matter claimed can be made or used in industry.